The TEWG Stock Status Subgroup identified data and gaps and research suggestions by drawing from the recent ASMFC stock assessment, Council documents, the ESA status review process, the input of the full TEWG, and the input and advice of Stock Status Subgroup members. All subgroup members were asked to provide their individual opinion on ranking for each of the suggestions, including the relative cost (1-9K, 10-99K,100-199K, >200K), time frame (Exists Already, Short-term, and Long-term), and comments. Below is a summary from the 8 subgroup members who provided their expert opinions.

Identified Research Recommendation	Stock Status Subgroup Comments	Time Frame		Rank		Relative Cost		Additional Information
		"E" =Exists already "S" =Short-term(1-3 yrs) "L"=Long-term (3+yrs)		(Use each value of 1 to 23 once, 1 being highest, 23 being lowest)		$ =1-9K $$ =10-99K $$$ =100-199K $$$$ =>200K		example: If you indicated "Exists already" for the Time Frame, provide a source or some furhter information on where it exists.
		Group Opinion	Distribution (S / L / E)	Group Opinion	Range (Min to Max)	Group Opinion	Range (Min to Max)	
Creation of a Standardized Sampling Guidance Document for the species population range.	Many of the identified research needs discussed had benefit from formation of this type of product.	**S**	100% / 0% / 0%	**1**	1 to 9	**$/$$**	$ to $$	Relates to item 3; ASMFC River Herring TC could possibly review, develop, support
Continue to assess current aging techniques for river herring, using known-age fish for age validation, scales, otoliths and spawning marks. Conduct biannual aging workshops to maintain consistency and accuracy in aging fish sampled in state programs.	Already occurring and ASMFC released final report; No "Known-age Library Collection"; Age and growth staff need something more definitive to demine aging protocol for herring. When do we move from assessing to implementing improved techniques?	**S**	64% / 21% / 14%	**2**	1 to 10	**$$**	$$ to $$$$	MADMF has ageing protocol that appears to produce good inter-group precision. Known age fish are the real key here, after that occurs informed decisions on structures and biases can be made.; Known-age fish technique should be developed and a reference collection is needed for each region to validate the differences in age-growth by states
Improve methods to develop biological benchmarks used in assessment modeling (fecundity-at-age, mean weight-at-age for both sexes, partial recruitment vector/maturity schedules) for river herring stocks.	Data quality is the limiting factor in previous assessments; Standardization of Sampling (i.e., weight more important than length?, timing of age samples?, scale or otolith?,etc..); Coast-wide workshop	**S**	64% / 36% / 0%	**3**	1 to 12	**$$**	$$ to $$$$	Dependent on item 1, requires multiple projects. Fecundity and time of year greatly complicates any type of relative weight development.
Validate [better estimate] the different values of M for river herring stocks and improve methods for calculating M. Summarize existing information on predation by striped bass and other species and quantify consumption through modeling (e.g., MSVPA), diet, and bioenergetics studies.	Should be some guidance (Standardized Sampling Guidance Document?) on what to collect to help understand; As fisheries close, does it end up: Z=M+ bycatch; Predation factor; Long term and high priority limited by available data and methods used;	**L**	14% / 86% / 0%	**4**	1 to 13	**$$$$**	$$ to $$$$	This requires a multitude of other things occuring beofre it can be reliably estimated. Not interested in a SWAG being used
Investigate the relation between juvenile river herring production and subsequent year class strength, with emphasis on the validity of juvenile abundance indices, rates and sources of immature mortality, migratory behavior of juveniles, and life history requirements.	Gary Nelson (MADMF) has been working on this and presented results at ASF (August 2014); Convincing trends; Could be affecting M and productivity; The model had very little explanatory power and low predictive capabilities	**L**	21% / 64% / 14%	**5**	2 to 13	**$$$**	$$ to $$$$	Needs to be done over large part of range to capture variabilty across habitat types. Some work in NE underway (UMASS/DMF); $$=w/ existing data; $$$$ = to obtain necessary missing data
Continue genetic analyses to determine population stock structure along the coast and enable determination of river origin of incidental catch in non-targeted ocean fisheries.	Fisheries and Genetics subgroups working on it already; Include in Standardized Sampling Guidance Document; Increase genetic samples	**S**	64% / 29% / 7%	**6**	2 to 12	**$$$**	$$$ to $$$$	Work on this beginning in 2015 funded by MADMF/TNC; Believe some work (Palkovacs?) has begun
Undertake an analysis of the consequences of interaction between the offshore bycatch fishery and those in the rivers	Need to ID source stock; Stock level or River Level?; Difficult to link to past catches, but could be used moving forward; This is once source needed to move to more detailed population models (away from data poor)	**L**	14% / 86% / 0%	**7**	1 to 22	**$$$/$$$$**	$$$ to $$$$	Dependent on improved stock discrimination techinques (relates to Items 5 and 6)
Determine and quantify which stocks are impacted by mixed stock fisheries (including bycatch fisheries). Methods to be considered could include otolith microchemistry, oxytetracycline otolith marking, genetic analysis, and/or tagging.	Emphasis on alternative tagging methods other than genetic; Stocking reduces the strength of genetic as only tool;	**S**	36% / 64% / 0%	**8**	1 to 12	**$$$/$$$$**	$$$ to $$$$	Dependent on previous item; S/L=work ongoing, probably complete soon, but needs long term monitoring to be useful in the future
Improve reporting of harvest by water body and gear.	Lot of room for improvement in terms of detail; Standardize across states;	**L**	43% / 57% / 0%	**9**	6 to 16	**$$**	$ to $$	

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Evaluate the use of large-scale hydroacoustic methods as a way to quantify river herring escapement (spawning run numbers) in major river systems.	Promising work by Ogburn lab using DIDSON; Acknowledging that DIDSON is expensive equipment, additional work with DIDSON could potentially be expanded to increase the spatial area of DIDSON use. Very expensive, very time intensive work	**L**	7% / 71% / 21%	**10**	4 to 18	**$$$$**	$$$ to $$$$	Giving the idea of developing alternative methods for escapement estimates a high priority rather than one SPECIFIC method; Still requires ground truthing by electrofishing but shows lots of promise and should be pursued.
Create a Sample Processing Repository/Fund Processing	Samples have been collected, but no money for process/analysis; It can be a bottleneck for projects; Developing an inventory of what is being collected by who is an important component; Not everybody is planning to do any post-processing of collected samples, but may be happy to provide samples to someone else for that purpose; Samples sent out or picked up for further analysis; Communication on how to store samples (can differ per analysis).	**S**	71% / 29% / 0%	**11**	3 to 18	**$$/$$$/$$$$**	$$ to $$$$	Currently much of what I think you mean by 'samples' is requested and processed by non-governmental entities. I think that centralized sample processing would need to be undertaken by federal lab with open access to all interested parties, governmental, academic, and private.
Explore use of peer-reviewed stock assessment models for use in additional river systems in the future as more data become available.	Possible after more data collection begins;	**L**	14% / 86% / 0%	**12**	3 to 18	**$**	$ to $$$	
Develop models to predict the potential impacts of climate change on river herring distribution and stock persistence.	Overlaps Climate Change and Stock Status; Could be incorporated into Ecosystem-Based model; NEFSC examining how to include into MARSS modeling.	**L**	100% / 0% / 0%	**13**	2 to 21	**$$**	$$ to $$$$	Would require reams of improved data to be worthwhile
Inclusion of Canadian data	Less of an issue if future focus is on river system level; Having Canadian fish data at the stock levels would be important; DFO personal communication indicated possible poor species identification; Climate change modeling might be misleading (shift rather than contraction); Would benefit the assessment	**S**	71% / 29% / 0%	**14**	7 to 19	**$/$$**	$ to $$	contraction/shift comment is spot on. Should be very easy to do, if you can get the data
Ecosystem Modeling	Has been discussed briefly at both subgroup meetings; What data sources are needed?; Would be a good direction to go into and no other subgroup is addressing it; Some efforts are underway but not ready for management at this point; Need to understand biomass and stock status before ecosystem models; With a species so apparently impacted by the environment, ecosystem modeling is not something to be kept on hold until we figure out biomass and stock status; Ecosystem modeling is meant to improve estimates of biomass and stock status by including environmental effects on biomass and stock status	**L**	86% / 14% / 0%	**15**	6 to 21	**$$$$**	$$$ to $$$$	Incredible lack of quality data across so many levels makes this a poor investment currently. JUNK IN = JUNK OUT; The dataset(s) needed to pull this together likley do not exist or are not complete enough currently. The task would require these datasets to be identified, then a standard collection method could be implemented, but years of data would need to occur, so it is long-term and high-cost.
Develop comprehensive angler use and harvest survey techniques for use by Atlantic states with open or future fisheries to assess recreational harvest of river herring.	NOAA's MRIP is primarily focused on catch in marine waters and is not designed for anadromous fish that migrate up river where recreational fisheries occur.	**L**	14% / 86% / 0%	**16**	8 to 22	**$$**	$$ to $$$	Incredibly low rec. harvest currently and ASMFC process should be ensuring that relative amount of catch is captured through SFMP protocols; With a harvest moratorium in Virginia this would have little value although there could be a very small amount of incidental catch and release.
Consider the use of GLM to provide better trend estimates and to better characterize uncertainty in trends.	Easy to do and should be done in next assessment: Won't "make or break" understanding of stock dynamic; Data is already available, but not a good use of time; GLM removes some of the environmental variability in indices.	**S**	67% / 33% / 0%	**17**	13 to 22	**$**	$ to $$	Not particularly important but not as poor idea as those ranked below it.

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Evaluate the performance of hatchery fish in river herring restoration.	USFWS in conjunction with MDNR are conducting a 6-yr project that does exactly this on the Patapsco River in Maryland; Do other efforts exist? Are methods comparable?; Don't think populations levels are at a point where hatchery production should be advocated for.	**L**	14% / 86% / 0%	**18**	8 to 21	**$$$**	$$$ to $$$	Would require sustained stocking of marked fish over multiple gens. Agree with comment re:population levels not at level where stocking should be preferred action; A small amount of herring stocking was conducted in a lower James trib with minimal, if any, hatchery returns found. Could be due to small stocking amount.
Develop bottom and mid-water trawl CPUE indices of offshore biomass.	Very Low Priority; Strongly go against using fishery-dependent for CPUE;	**L**	43% / 57% / 0%	**19**	7 to 23	**$/$$$**	$ to $$$$	Long term and would cost lots of money, However, probably essential to larger modeling efforts as spatio-temporal overlap of current NOAA trawl survey is not ideal for accurately portraying ocean dsitribution of the two spp.
Development of better fish culture techniques and supplemental stocking strategies for river herring.	Stocking strategy that should take into consideration current scientific recommendations : use caution when stocking and use for only extirpated runs with geographically close source population; *(See Palkovacs et al. 2014. Combining genetic and demographic information to prioritize conservation efforts for anadromous alewife and blueback herring. Evolutionary Applications. 7:212-226);* See very little benefit from culture/hatchery enhancement; not incredibly supportive of trap and transport either.	**S**	36% / 64% / 0%	**20**	9 to 23	**$$$**	$$ to $$$$	RH are highly fecund with greater straying rate than many other anadromous spp. Fish culture techniques not needed at this time. Limited work by Berlinsky indicates it won't be hard
MARSS model	Investigate using just the offshore strata in order to extend the time series further back in time. Also, assume separate underlying states/stocks in the coastwide model and estimate how they interact with each other. Neither of these models are really that good now; As such put these as low priorities with higher priority of collecting improved data to facilitate the use of better models.	**L**	36% / 64% / 0%	**21**	15 to 22	**$$**	$ to $$$	Focus should be on generating quality data so inferior models are not needed; S/L=can be done in the short term, but would be better or more useful with better data which will need the long term timeframe to collected
DBSRA model	Obtain a time-varying element for the carrying capacity (K) (versus an estimate for the parameters for the entire series). Explore use of index to tune model (X-DBSRA)	**L**	36% / 64% / 0%	**22**	16 to 23	**$$**	$ to $$$	Focus should be on generating quality data so inferior models are not needed; S/L=can be done in the short term, but would be better or more useful with better data which will need the long term timeframe to collected
Investigate contribution of landlocked versus anadromous produced fish.	Important issues for this: 1) Collection of before and after data, 2) Set-up viable impact evaluation study design before restoration project is implemented, 3) Continuation of monitoring of e.g. fishways after implementation; Don't think this should be on the research list for stock status	**L**	29% / 71% / 0%	**23**	15 to 23	**$$**	$$ to $$$$	This is pointless. How many LL populations of significance occur?